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**RESEARCH
NOTES:**

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ARIZONA ALTERNATE ROUTING INFORMATION SYSTEM

Traffic incidents that cause closures and create detours have predicated the need for a standardized compendium of authorized alternative routes in Arizona. A systematic approach to disseminating detour information – as well as maintaining an alternate route database, has been the focus of recent research.

Background

In a previous project (AZ-485), Arizona DOT embarked on an effort that provided statewide detour plans for major links of rural Arizona roadways delivered in print format from an electronic tabular database that utilized a use-restricted GIS library and proprietary GIS toolset.

That effort built upon non-standardized detour plans already on-file in many ADOT District offices. The output addressed the stated needs of that previous research, creating the printed format that could be distributed to roadway operations and public safety personnel statewide.

The previous effort also made a significant advance in bringing ADOT and DPS personnel together to review the actual detours for each closure link. The resultant product was a thick three-ring binder of tabular printouts that could be carried by maintenance personnel and highway patrol staff.

The principal recommendation of the earlier research was the creation of an interactive routing tool. The stakeholders who developed and reviewed the detours in regional workshops were impressed with the GIS application that helped generate the output – but lost enthusiasm with the tabular workbook because of its 3-inch, 750-page bulk. The tabular link detail of the printouts was not effective compared to the interactive map presentation detail of a GIS-based product.

Objective

The objective of this project is to carry forth the principal recommendations of the previous research and deliver an implementable interactive alternative route decision-making tool for roadway operations and public safety personnel statewide. This tool would be called ARIS. It would provide access to an official set of alternative routes – yet also allow users to generate ad hoc detours interactively to test different routing scenarios. The focus would be on developing and test-driving the ARIS application with a group of 40 stakeholders across ADOT District offices and invite DPS personnel to participate on their own volition.

Approach

The tactical approach included a project work plan that concentrated on tool development

and data development by the research team from Works Consulting. ADOT and DPS provided support for the approach through the Technical Advisory Committee, which was largely the same group of advisors that served on the previous research project.

The research team met with the TAC five times during the course of the project. Communication between TAC meetings was further supplemented by telephone, e-mail, and fax – as well as by establishing a project website at <http://www.itwillwork.com/aris>.

Project Website

The project website included download links for updating to newer versions of the ARIS application, documentation, data, and video help files. It also included a feedback form for users to register issues that were observed during testing of the application.

Design Methodology

In order to make the most of the available research timeline, the research team was granted the first five weeks of the project to rapidly produce the prototype ARIS application that was specified. This method proved successful as 80 percent of the functionality was delivered prior to the project kickoff meeting that included the full TAC. This result generated good enthusiasm for the remainder of development discussion at the five meetings. The prototype was well accepted and subsequent feedback from the TAC determined that a beta testing program could begin immediately among the TAC and designees of the TAC.

Software Methodology

In order to comply with state government policy, the ARIS application would employ software components compliant with ESRI products, which have been in use at ADOT since 1991. Because the ARIS specification called for deployment on computers that are disconnected from any wide area network, the research team settled on a Microsoft Visual Basic application utilizing

ESRI MapObjects® components for graphic map interfaces and ESRI NetEngine® components for solving the best path scenarios.

Auxiliary Data Development

The interactive map environment of the specified application would need to access and maintain the eventual library of official alternate routes. But the same interface was specified to access other datasets that would expose relevant issues regarding alternate route selection. Hence, a significant amount of the research budget was dedicated to preparing auxiliary datasets such as:

- Highway Centerlines (including alternate routes that are outside of Arizona).
- Bridge Locations (to access capacity and ownership information).
- Regulation Speed Limits (to determine approximate travel times).
- Functional Classification Segments (to approximate travel times where speed limits are not available).
- Height and Width Restrictions (where stationary physical constraints impede vehicles of certain characteristics).
- Variable Message Sign Locations (where messages can be displayed to forewarn travelers).
- Highway Closures and Restrictions (where dynamic temporal closures and restrictions can be accessed).

Beta Test Program

A beta testing program was commenced following the second TAC meeting and continued for 12 weeks prior to field deployment. Testers included interested TAC members and a few of their designated personnel. The beta software was supported by website, e-mail, and telephone correspondences. The beta test feedback resulted in 40 issues being logged to the feedback form on the website. The research team continued to address the issues brought forth by the beta testers as they proceeded to make an ARIS application that was fully functional. Data technicians with

the research team tested the application by assembling the representative library of alternate routes from the three-ring binder product of the previous research.

Field Test Deployment & Training

A critical phase of ARIS development was the statewide Field Test program that took the application to a much larger group of stakeholders and users. Four regional workshops were conducted in Phoenix, Tucson, Flagstaff, and Prescott in an eight-day period at the end of October. Computers were supplied by the research team for a hands-on experience. The meetings reached 46 ADOT employees and 15 DPS personnel, not including the TAC.

Workshops were advertised in relatively short 2½-hour timeslots (with refreshments provided at break) with the idea of generating more enthusiasm by downplaying the amount of training necessary. Beta testing feedback determined that the interface was relatively straightforward – so the workshops intended to capitalize by not becoming too detail-oriented.

The research team acknowledged that the ARIS tool would perhaps be used only when an alternate route plan was needed – which could mean that some end-users might use ARIS only on a semi-annual basis. Hence the learning curve for resuming use of the application could not be hindered by the lack of constant use of the program.

This issue was challenged by preparing a computer-based training (CBT) companion CD for ARIS. The CBT was integrated into the ARIS Help utility so that users could self-train on an as-needed basis. The CBT consisted of 35 individual digital screen-capture video files that can playback on a standard computer media player. The entire course takes about 45 minutes to review.

The fact that the CBT was introduced at the workshop made field testers realize they didn't have to cram the ARIS learning experience into the 2½-hour introductory

workshops. Instead, they could take a relaxed approach and watch the software demonstration without the need to take notes, or even follow along on the provided computer.

It was interesting that the primary discussion during the regional meetings centered on the auxiliary data that was presented in the ARIS interface. Many participants had not previously been introduced to geographic information systems. Not to trivialize the capability of the interactive alternate route generating capability, but the feedback suggested that the users clearly understood how ARIS could become an indispensable tool for accessing general GIS datasets – let alone alternate route plans.

Feedback Program

To facilitate comprehensive feedback, the research team prepared a series of follow-up bulletins designed to encourage the participants of the regional workshops to test drive the ARIS application at their desktop and then answer a few short questions.

Four bulletins were distributed by e-mail and fax over a three-week period in January. The resultant feedback was very encouraging and suggested that the ARIS project was indeed a success. Outstanding issues that the research team had identified were deemed irrelevant to the common ARIS users. In general, the application is ready to be deployed.

Deployment Options

The original deployment scenario at the time the research project started was to provide 40 copies of the ARIS application that could be installed on up to 40 different computers statewide – including DPS. The licensing cost of these 40 seats was included in the original research budget.

But some of the feedback received suggested that the initial plan of having users access the detours from mobile laptops in the field is possible and indeed desirable but perhaps

unlikely. Because of a variety of factors, it appears more likely that a typical non-computer field person in need of an alternate route plan would contact a district or centralized dispatcher and would be willing to receive that plan by phone, fax, or e-mail. This recognizes that two different classes of ARIS users emerged during the study: those that create/maintain alternate routes – and those that simply need to use and deploy the detour plans in the field.

Hence, the options for deploying ARIS became more flexible than initially defined. The use of ARIS to maintain or generate detours in the library of approved alternate routes can be concentrated on a smaller number of computer-savvy staff who feel comfortable with the installable ARIS application.

By relaxing, yet maintaining, the specification set for mobile users, the ARIS database of approved detours can now potentially be disseminated via the Internet or limited to the ADOT Intranet – allowing any user who can negotiate a web browser to be able to print out a detour description and map.

Recommendations

It is recommended that ARIS be deployed in a combination of installable licensed seats for those who may maintain or update it, and for detour generators – as well as on a wide-area basis using the Internet or ADOT Intranet. The benefit of the Internet over the Intranet is that the official detour library – complete with detour descriptions and maps – becomes accessible to other agencies including the DPS. Access restrictions can always be implemented to prevent dissemination to the general public.

In order to offer an example of this recommendation, a mock ARIS Internet site was created. It was accessible during the project from a link on the www.itwillwork.com jumpsite. The site is further explained in a fifth “how-to” bulletin distributed in Appendix C of the full report and also accessible from the Internet jumpsite. Alterations to the example site are indeed possible and would occur in the

event that ADOT chooses to deploy the ARIS library over such a web interface.

Maintenance Support

The ARIS database will only be useful if it is maintained to satisfaction of the end-user. With roadway realignments and changes in roadways brought forth by development, the choice of alternate routes can change constantly.

It is recommended that ARIS be implemented in a program that includes a blanket review of the existing detours in the original library – as well as accommodate additional alternate routes not defined at the end of the 1999 project.

It is also recommended that the ARIS centerline file be continually updated to reflect recent changes in the ATIS Roads centerline file. Furthermore, the auxiliary datasets that help to determine the best detour options should be maintained for benefit of ARIS users.

Technical documentation of the ARIS application is also recommended – should the program be managed in-house at ADOT. A NetEngine® license will be a significant additional cost if ADOT so wishes to run the ARIS program with internal staff (as opposed to a contracted service).

Deployment Costs

The research team, at the TAC’s direction, presented the TAC with deployment options that range between only installable ARIS deployment and full Internet deployment. First year costs range between \$27,000 and \$46,000. Annual maintenance costs range between \$2400 and \$4800. Pros and cons – as well as the details of the cost considerations – are provided in the full report.

Note: The full report on this project, *Arizona Alternate Routing Information System*, by Jerome P. Breyer (ADOT, report FHWA-AZ-02-513, published May 2002) may be obtained from the ATRC as listed below.

For Additional Information Contact:

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